

Engineering and Design  
DESIGN OF BREAKWATERS AND JETTIES

## Table of Contents

<u>Subject</u>	<u>Paragraph</u>	<u>Page</u>
CHAPTER 1. INTRODUCTION		
Purpose	1-1	1-1
Applicability	1-2	1-1
References	1-3	1-1
Bibliography	1-4	1-2
Background	1-5	1-2
Inventory	1-6	1-2
Symbols	1-7	1-2
General	1-8	1-2
Definitions	1-9	1-3
Types of Breakwaters and Jetties	1-10	1-3
CHAPTER 2. FUNCTIONAL DESIGN		
Design Overview	2-1	2-1
Design Studies	2-2	2-2
Typical Engineering Studies	2-3	2-2
Water Levels and Datums	2-4	2-3
Waves	2-5	2-4
Currents	2-6	2-6
Geotechnical Considerations	2-7	2-6
Ice Conditions	2-8	2-7
Shoreline Changes	2-9	2-9
Prior Projects and Their Effects	2-10	2-9
Baseline Surveys	2-11	2-9
Design Life, Degree of Protection, and Design Conditions	2-12	2-10
Dredging and Disposal	2-13	2-10
Seismic Design	2-14	2-13
Environmental Impact	2-15	2-13
Model Tests	2-16	2-13
Operation and Maintenance (O&M)	2-17	2-13

8 Aug 86

	<u>Subject</u>	<u>Paragraph</u>	<u>Page</u>
CHAPTER 3.	BREAKWATER AND JETTY PLANS		
	Objective	3-1	3-1
	Layout Options	3-2	3-1
	Selection of Structure Types	3-3	3-7
CHAPTER 4.	DESIGN OF RUBBLE-MOUND STRUCTURES		
	Definition	4-1	4-1
	Selection of Design Wave	4-2	4-1
	Concrete Armor Units	4-3	4-2
	Special Stone Placement	4-4	4-7
	Overtopped Breakwaters	4-5	4-7
	Estimating Wave Runup	4-6	4-7
	Selection of Armor Type and Weight	4-7	4-7
	Selection of Seaside Armor Slope	4-8	4-11
	Selection of Harbor-Side Armor Slope	4-9	4-11
	Detailing Structure Cross Section	4-10	4-11
	Use of Concrete Caps	4-11	4-17
	Design of Structure Head and Lee-Side Armor	4-12	4-17
	Example of Preliminary-Design Details	4-13	4-18
	Sealing Rubble-Mound Jetties or Breakwaters	4-14	4-21
	Quality Control Specification Requirements for Construction Materials	4-15	4-22
	Rehabilitation	4-16	4-23
	Maintenance	4-17	4-23
CHAPTER 5.	DESIGN OF VERTICAL WALL STRUCTURES		
	Sheet-Pile Structures	5-1	5-1
	Steel Sheet Piles	5-2	5-1
	Timber Sheet Pile	5-3	5-3
	Reinforced Concrete Piling	5-4	5-7
	Wave Force Computations	5-5	5-7
	Maintenance	5-6	5-11
	Rehabilitation	5-7	5-13
CHAPTER 6.	DESIGN OF FLOATING STRUCTURES		
	Floating Breakwater Applicability	6-1	6-1
	Floating Breakwater Groups	6-2	6-1
	Operational Considerations	6-3	6-2
	Pontoon Floating Breakwaters	6-4	6-5
	Scrap-Tire Floating Breakwaters	6-5	6-20
	Models	6-6	6-34
	Prototype Tests	6-7	6-34
	Maintenance	6-8	6-35
	Rehabilitation	6-9	6-35

<u>Subject</u>		<u>Paragraph</u>	<u>Page</u>
CHAPTER 7.	OTHER BREAKWATERS		
	General	7-1	7-1
	Pneumatic Breakwater System	7-2	7-1
	Hydraulic Breakwater System	7-3	7-3
	Sloping Float Breakwater	7-4	7-6
CHAPTER 8.	ENVIRONMENTAL IMPACTS		
	General	8-1	8-1
	Physical Impacts	8-2	8-1
	Water Quality Impacts	8-3	8-2
	Biological Impacts	8-4	8-2
	Short- and Long-Term Impacts	8-5	8-4
	Socioeconomic and Cultural Impacts	8-6	8-5
	Evaluation of Project Alternatives	8-7	8-5
CHAPTER 9.	OTHER CONSIDERATIONS		
	General	9-1	9-1
	Aesthetics	9-2	9-1
	Fishing Platforms	9-3	9-1
	Aids to Navigation	9-4	9-1
	Construction Methods	9-5	9-1
CHAPTER 10.	DESIGN OPTIMIZATION		
	Design Optimization	10-1	10-1
	Alternative Structures	10-2	10-2
CHAPTER 11.	MODEL STUDIES		
	General	11-1	11-1
	Purpose of Model Tests	11-2	11-1
	Field Data Required	11-3	11-1
	Selection of Model Scale	11-4	11-2
	Model Laws	11-5	11-2
	Wave Generators	11-6	11-3
	Bottom Slope	11-7	11-3
	Method of Constructing Test Sections	11-8	11-3
	Still Water Levels	11-9	11-3
	Wave Characteristics	11-10	11-3

<u>Subject</u>		<u>Paragraph</u>	<u>Page</u>
CHAPTER 12.	PERFORMANCE MONITORING PLAN		
	Need	12-1	12-1
	Scope	12-2	12-1
	Inspection	12-3	12-1
	Monitoring Projects	12-4	12-1
APPENDIX A.	BIBLIOGRAPHY		A-1
APPENDIX B.	INVENTORY OF U.S. ARMY ENGINEER WATERWAYS EXPERIMENT STATION MODEL TESTS		B-1
APPENDIX C.	NOTATION		C-1
APPENDIX D.	SUMMARIZED INVENTORY OF CORPS OF ENGINEERS BREAKWATERS AND JETTIES		D-1